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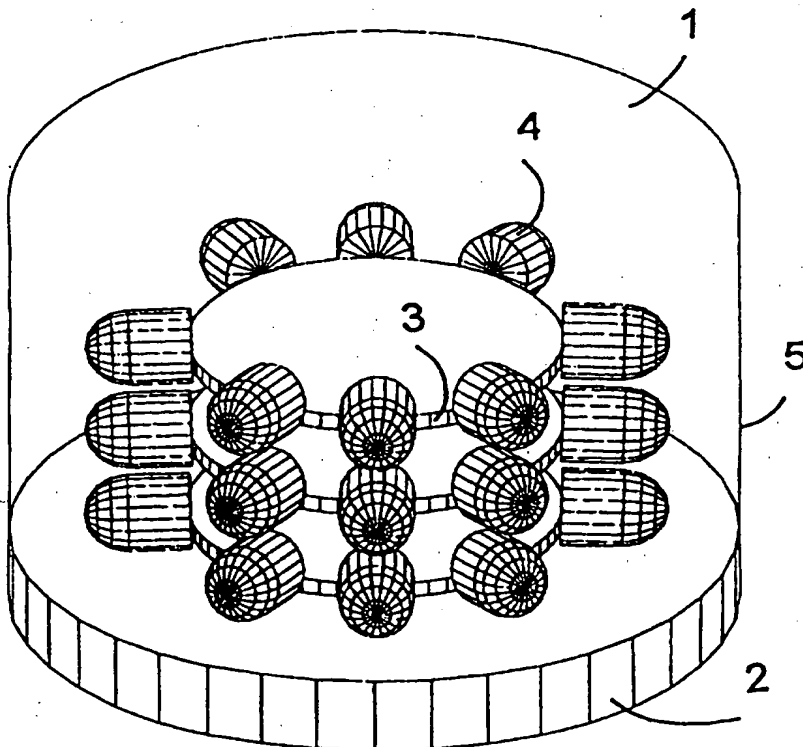
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : F21Q 3/00		A1	(11) International Publication Number: WO 97/29320
			(43) International Publication Date: 14 August 1997 (14.08.97)
(21) International Application Number: PCT/FI97/00083		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).	
(22) International Filing Date: 10 February 1997 (10.02.97)			
(30) Priority Data: 960597 9 February 1996 (09.02.96) FI			
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(54) Title: FLIGHT OBSTACLE LIGHT

(57) Abstract

Flight obstacle light to warn pilots about flight obstacles, said light comprising a base (2), a source of light and a cover (5). The source of light is implemented with LEDs (4) that are connected next to each other and at least in one layer onto a circuit board section (3) in order to achieve the lighting pattern and intensity required. The present invention allows a use of low input voltages, such as 48 V, which makes the light extremely safe to operate. Further, the light uses DC voltages and can therefore be easily used even in remote locations. Furthermore, its power consumption is remarkably low and its lifetime several times longer than that of the incandescent lamps. This reduces the need for servicing and decreases maintenance costs. Moreover, the present invention is small and lightweight.



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FLIGHT OBSTACLE LIGHT

The present invention relates to a flight obstacle light as defined in the introductory part of claim 1. The function of the light is to warn pilots about flight obstacles, such as high buildings, radio masts and chimneys.

The electrical, photometric and mechanical specifications of flight obstacle lights are given, e.g. in the ICAO (International Civil Aviation Organization) Aerodromes Annex 14 volume 1, Second Edition, July 1995, chapter 6 "Low-intensity obstacle light", and in the FAA (Federal Aviation Administration) AA No:150/5345-43E "Specification for Obstruction Lighting Equipment". According to these specifications, the flight obstacle light has to be able to produce, i.a. a horizontal beam spread of 360 degrees and a vertical beam spread of more than 10 degrees. Further, the intensity has to be more than 10 cd of red light, and the wave length of the red colour must fall within the range of 610 - 670 nm.

The flight obstacle lights currently in use are typically 100 W incandescent lamps housed inside red protective covers. The main drawbacks of these common flight obstacle lights are high power consumption and short service intervals. Moreover, the rather high AC voltage of e.g. up to 230 VAC, required by these lights, may turn them a hazard should they become defective.

The object of the invention described here is to eliminate the drawbacks of the common technique and to create a totally new type of flight obstacle light in which the light source consists of several LEDs (Light Emitting Diodes) as defined in the enclosed claims.

The present invention requires low input voltages, e.g. 48 V, which makes it very safe. A further advantage is that it

uses DC voltages and can therefore be easily used even in remote locations, such as base stations of a cellular telephone network, where batteries may be used to generate the DC voltages required. Furthermore, the power consumption of the light is very low, typically at the level of 10 W, which is remarkably lower than that of the incandescent lamp lights. In addition, its lifetime is several times longer than that of the incandescent lamps. This reduces the need for servicing and decreases maintenance costs. In addition, the present invention is small and lightweight.

In the following, the invention is described in detail by the aid of examples and by referring to the attached drawings, in which

Figure 1 presents the flight obstacle light,

Figure 2 presents the flight obstacle light of figure 1 when fixed to a terminal box,

Figure 3 presents the flight obstacle light of figure 1 when fixed to another terminal box, and

Figures 4a to 4c present the LED connections used in this invention.

The flight obstacle light depicted in figure 1 consists of a base (2) with which the light can be fixed to the terminal box below it. On top of the base, there is the electronics part that consists of several, e.g. three pieces in figure 1, disk-shaped circuit boards (3) containing the control electronics for the light. Red LEDs are evenly attached onto the outer edge of each round circuit board. The number of LEDs must be adequate, e.g. in figure 1 eight LEDs per circuit board which totals 24 LEDs, to guarantee both the ligh-

ting intensity required, the minimum being 10 cd, and the lighting pattern desired so that the flight obstacle light produces a light with horizontal beam spread of 360 degrees and a vertical beam spread of 10 degrees or more, e.g. 30
5 degrees. The lighting pattern required can be achieved by using LEDs that provide a beam spread of adequate width.

The light uses low DC voltages, such as 12 V, 24 V or ideally 48 V, received e.g. from a battery via the terminal box.
10 The electronics part contains one or more constant current or constant voltage power supplies to ensure stable lighting intensity. It is also possible to install a photocell to the light so that the light will turn on as controlled by the photocell when it is dark, or to use a flash controller to
15 make the light flash. The LEDs are housed inside an uncoloured protective glass cover (5).

Figure 2 presents the flight obstacle light (1) fixed on top of a terminal box (6) which contains a cover piece (7) fixed
20 with screws, and on the bottom, a lead-through for power supply cables. In figure 3, both the terminal box and the base are of cylindrical shape.

Figure 4a shows 24 LEDs (4) that have been connected into
25 four branches each of which can be located on separate circuit boards (3). Constant current power supplies (40) have been connected to each branch, and there is also a Zener diode (41) at the power supply input to protect the light against transient voltages. Instead of a Zener it is possible
30 to use a varistor for transient and disturbance protection.

In figure 4b, the LEDs (4) have been divided into two branches, and a Zener diode (42) has been connected in parallel

with every LED (4), this enables the current flow in case an LED became defected. A failure of one LED will thus have no effect on the other ones, but the rest of the LEDs in the same branch will still operate normally. Further, at the input there are a photocell (43) and a temperature sensor (44) connected in parallel. They control the light to be continuously lit not only when it is dark but also when it is cold (i.e. when the temperature falls under a certain limit); this prevents moisture from being condensed inside the cover and the light to be damaged.

In figure 4c, a Zener diode (42), enabling the current flow if an LED fails, has been connected in parallel with two LEDs (4). This ensures that most of the LEDs of the same branch will operate normally, e.g. four out of six LEDs in figure 4c, even though one LED would fail.

It is obvious to a person skilled in the art that different applications of the invention are not restricted to the examples described above, but they may vary within the scope of the claims presented later on. Instead of disk-shaped circuit boards, it is possible to use a flexible elastic circuit board which is twisted into a cylindrical shape and onto which the LEDs are connected by soldering. The desired lighting pattern can be achieved by bending the elastic circuit board, by changing its shape and altering the placement of the LEDs on the circuit board. Further, it is possible to modify the connection so that the light can be fixed directly to the base of an incandescent lamp, e.g. E27. When this is done, it has to be born in mind, however, that the LEDs require a DC power supply.

CLAIMS

1. Flight obstacle light to warn pilots about flight obstacles, said light comprising a base (2), a source of light
5 and a cover (5),

characterized in that

10 the source of light consists of LEDs (4) that are connected next to each other onto a circuit board section (3) in one or more layers in order to achieve the lighting pattern and intensity required.

2. Flight obstacle light (1) according to claim 1, characterized
15 in that it comprises at least two circuit board layers.

3. Flight obstacle light (1) according to claim 1, characterized in that the LEDs are connected onto disk-shaped circuit boards (3) laid above each other.
20

4. Flight obstacle light (1) according to claim 1, characterized in that the LEDs are connected onto one or more elastic or flexible circuit board, so that the lighting pattern
25 required can be achieved by bending the circuit board, and by changing its shape and the location of LEDs on it.

5. Flight obstacle light (1) according to claim 1, characterized in that it allows a connection of an electronically
30 controlled stabilizer unit, such as a constant current or constant voltage power supply, to stabilize to lighting intensity.

6. Flight obstacle light (1) according to claim 1, characterized

rized in that it allows a connection of a photocell which controls the light and forces it to turn on when the ambient light intensity decreases below a predefined level.

5 7. Flight obstacle light (1) according to claim 1, characterized in that it uses DC voltages lower than 60 V, ideally 12 V or 48 V.

10 8. Flight obstacle light (1) according to claim 1, characterized in that protecting components, such as Zener diodes (42), are connected in parallel with the LEDs so that each Zener allows current flow through it should an LED connected in parallel with it become defected; this ensures that only the LED or LEDs that are connected in parallel with the
15 protecting component stop operating in a fault situation, whereas all the other LEDs will operate normally.

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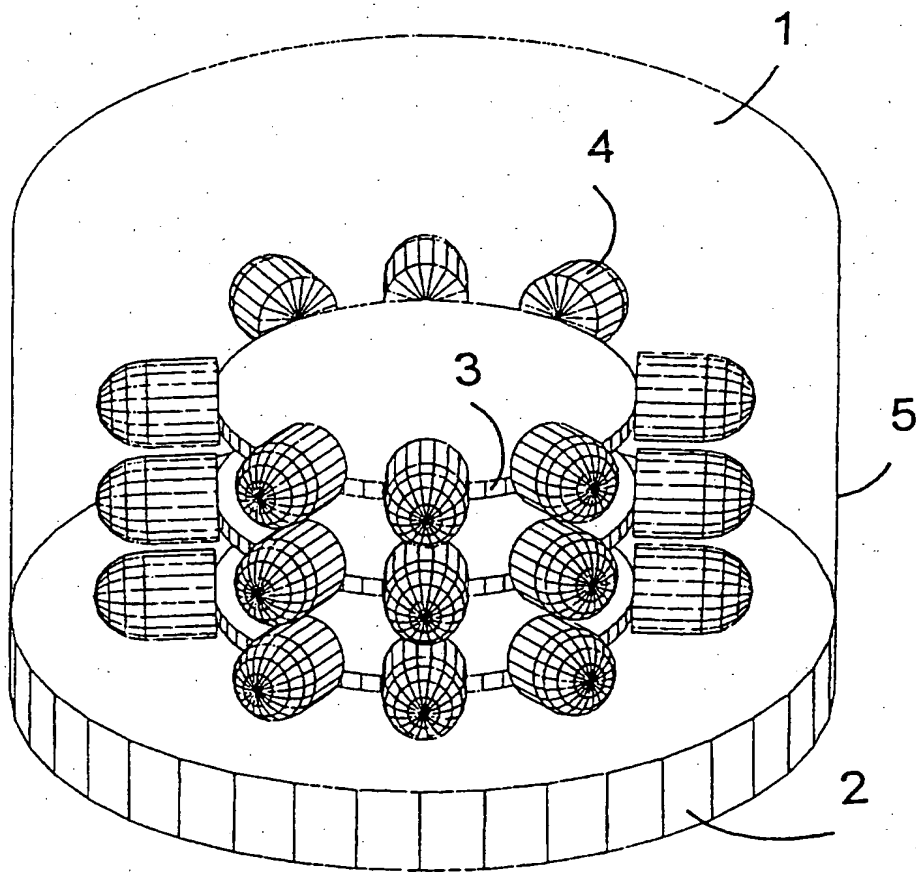


FIG.1

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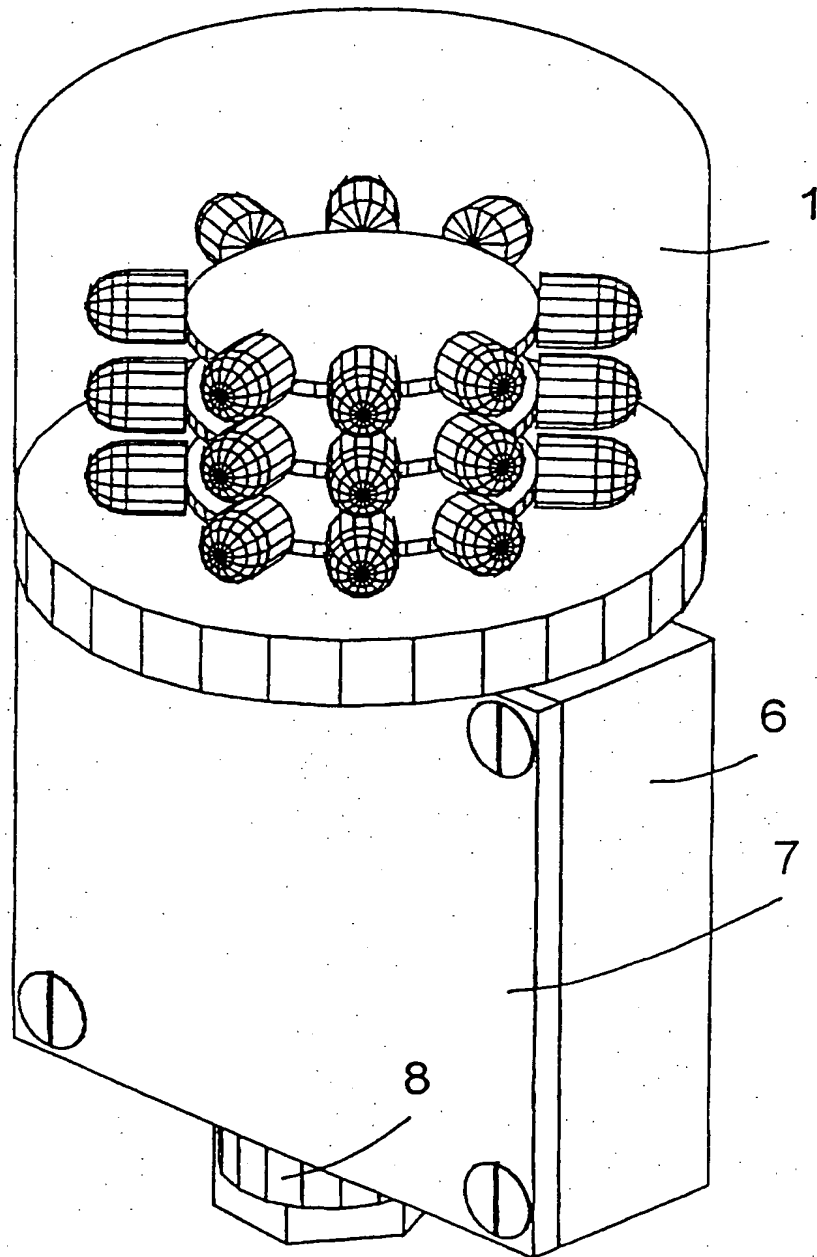


FIG.2

3/4

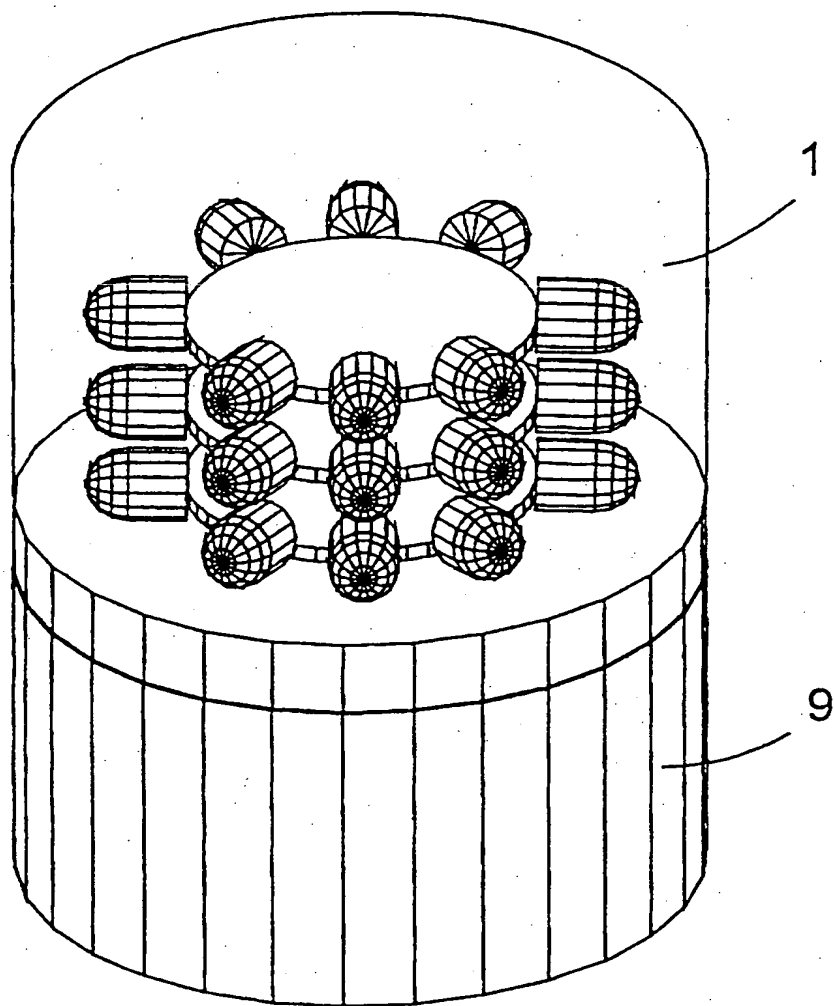


FIG.3

4/4

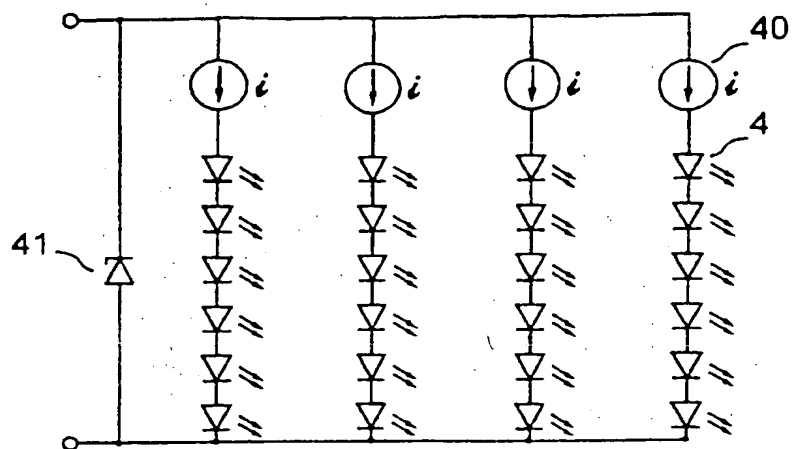


Fig. 4a

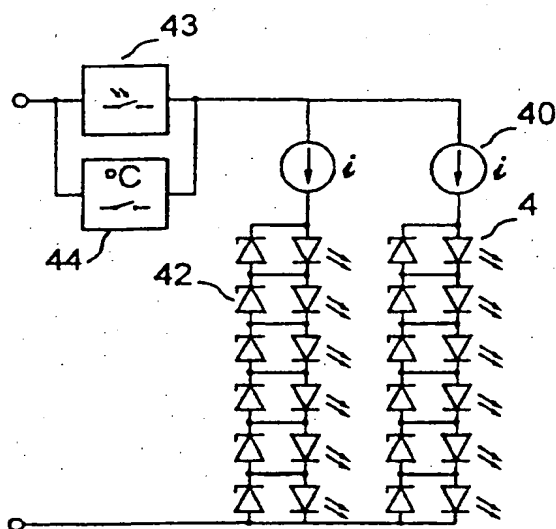


Fig. 4b

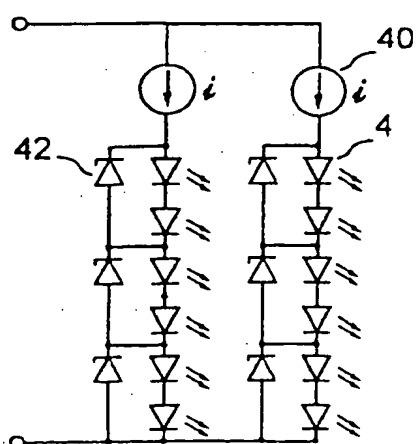


Fig. 4c

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 97/00083

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: F21Q 3/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

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IPC6: B64F, F21Q, F21S, F21V

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9523313 A1 (ADM-DELTA LIMITED), 31 August 1995 (31.08.95), figures 1-3 --	1-3
X	WO 9519525 A1 (S A APEX INGENIERIE S.A.), 20 July 1995 (20.07.95), figures 1-4, abstract --	1-3
X	DE 3806217 A1 (SCHUNK METALL UND KUNSTSTOFF GMBH), 7 Sept 1989 (07.09.89), figures 1,2, abstract --	1-3
A	US 4439818 A (SCHEIB), 27 March 1984 (27.03.84) --	

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	US 5321593 A (MOATES), 14 June 1994 (14.06.94) --	
A	US 5404282 A (KLINKE ET AL), 4 April 1995 (04.04.95) -----	

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Information on patent family members

02/04/97

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